Analysis on Overhaul Technology of Boiler Tail Heating Surface in Thermal Power Plant

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Abstract: In the working process of the boiler in the thermal power plant, the fuel is released and the heat energy is released, and the water in the boiler is turned into superheated steam. Under the action of the steam, the normal operation and operation of the steam turbine are promoted, and finally the steam turbine is normally generated. During the operation of the boiler, the metal surface on the side of the flame or the flue gas is the heating surface of the boiler. If there is a problem in the heating surface of the boiler tail, the working efficiency of the boiler will decrease, which will affect the normal production of the thermal power plant. This paper mainly discusses the overhaul and troubleshooting methods of the heating surface of the boiler at the end of the thermal power plant. It mainly introduces the maintenance methods and troubleshooting methods for common faults such as wear and low temperature corrosion, and introduces several other problems to communicate and discuss with the vast number of peers.

1. Introduction

The fly ash wear on the heating surface of the boiler will have an important impact on the long-term safe operation of the boiler. The fly ash particles in the flue gas have a certain hardness below 700 °C, and the lower the temperature, the greater the hardness of the fly ash particles. It will produce a certain grinding effect on the heated surface tube. The long-term wear of the heated surface tube will become thinner and thinner, the strength will become lower and lower, and eventually leakage will occur. If the heated surface tube is severely worn, it will show the characteristics of thinning of the tube wall, and some of the surface is relatively smooth, and some are honeycomb-shaped. The composition of the ash particles, the ash content, the kinetic energy of the ash particles, and the concentration of the fly ash have a direct impact on the wear rate of the fly ash. Specifically, the wear rate can be calculated by the following formula:

Wear rate (nm/year) = 57.2 * wear coefficient * (% ash /% carbon content) * flow rate 3.3 / flue gas temperature K

The routine maintenance methods for the wear of the heating surface of the boiler include hand touch, visual inspection, measurement, flaw detection, etc. The hand touch is to close the heat-receiving surface tube for defects such as wear and blow damage. Usually the hand touch is the most common and most effective inspection method. The visual inspection is mainly for the place where the hand can't touch, and the defect is inspected visually by the eye; the measurement mainly uses the thickness gauge to measure the wall thickness of the heat pipe, or the tool diameter is measured by a tool such as a vernier caliper, and the pipe diameter expansion condition can be checked. Therefore, the wear condition of the heat pipe is judged; the flaw detection and repair mainly checks whether the pipe has a weld port defect or a crack of the component by means of X-ray, ultrasonic flaw detection, coloring flaw detection and the like.

For the problem of wear on the heating surface of the boiler, it can be treated by adding anti-wear tiles, adding baffles, spraying anti-wear coatings, etc. Adding anti-wear tiles is the most commonly used anti-wear method in thermal power plants; Installed on the wall around the flue of the boiler tail, it can block the flow and eliminate the smoke corridor. Anti-wear coatings are mainly used in wearable areas, but spray anti-wear coatings are only used for surface treatment, not only to prevent wear and tear, but also to verify whether it will affect the heat transfer of the heated tubes, so the method of spraying anti-wear coatings Less application.

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2. Analysis of Low Temperature Corrosion of the Heating Surface of the Tail of Thermal Power Plant Boiler

Corrosion of the heating surface of the boiler tail is low temperature corrosion. Although the tail of the air preheater is the most common part of low temperature corrosion, this problem may occur in the air blower, iron flue, and economizer. According to the mechanism of corrosion, low temperature corrosion includes oxygen corrosion on the steam side, corrosion under the scale, high and low temperature corrosion, stress corrosion and the like. The main causes of low temperature corrosion on the heated surface include the following:

First, oxygen corrosion. There is water, moisture and other phenomena on the inner wall of the furnace tube. Once the protective film on the inner wall of the furnace tube fails, oxygen will be generated after entering the outside oxygen. The higher the temperature of the liquid, the concentration of oxygen ions, chloride ions and sulfate ions in the aqueous solution. The higher the rate of oxygen corrosion, the faster. During the operation of the boiler, if the deaerator fails or the water supply is not completely deaerated, it will cause oxygen corrosion in the economizer tube. The higher the flow rate of the medium, the faster the oxygen corrosion rate will be. Second, the scale is corroded. The main reason is that due to the leakage of the condenser or the failure of the water treatment equipment, the feed water contains excessive salt and oxygen, and the water wall tube has a higher heat load to the inner side of the fire side. The long-term deposition of the feed water will cause scale corrosion, after scale formation. It will further deteriorate the heat transfer performance of the pipe wall, making the corrosion under the scale faster and faster. Thirdly, the high and low temperature corrosion is mainly due to the fact that the fuel contains other components, and the local heat load of the heat pipe is too high. The corrosive low melting point compounds such as sulfur, vanadium, potassium and sodium contained in the fuel adhere to the metal surface to form high temperature corrosion; Corrosion is mainly caused by the combination of oxygen in the flue gas and sulfur in the fuel, resulting in a low temperature corrosion of the heated surface wall below the flue gas dew point. In addition to the high-temperature and low-temperature corrosion of the compounds contained in the fuel, the ash deposits on the heated surface, slagging, oxidation of the flue gas, poor combustion in the furnace, and unreasonable combustion field of the flue gas may also affect the corrosion of the heated surface. . Finally, stress corrosion. The main reason is that if the heat pipe has stress during operation, manufacturing installation, temperature and tissue change, stress corrosion will occur due to the action of alkali and chloride ions in the vapor-water medium, and the content of corrosive substances in the vapor-water medium is higher. The higher the temperature of the steam-water medium and the greater the stress on the heat-treated tube, the more severe the stress corrosion.

For the low temperature corrosion of the heating surface of the tail of a thermal power plant boiler, it can be prevented from the following aspects:

First, the fuel is subjected to desulfurization treatment. Coal combustion is the main source of sulfur. Therefore, measures should be taken from the source to reduce the formation of sulfides and desulfurization of fuels. However, the desulfurization treatment is only applicable to coal-fired power plants, and the wastewater after desulfurization should be recycled as much as possible. Separation of sulfur not only improves its application value, but also avoids environmental pollution.

Second, reduce the oxygen content in the boiler. During the operation of the boiler, oxygen will promote the conversion of sulfur dioxide to sulfur trioxide, which is the main cause of low temperature corrosion. Therefore, it is necessary to control the oxygen content in the boiler to reduce the formation of sulfur trioxide; and the reasonable control of oxygen content can also be reduced. Dew point temperature to reduce low temperature corrosion problems. During the operation of the boiler, it is necessary to strictly control the air system and do a good job in testing the oxygen content. It is necessary to make timely adjustments when the air coefficient is unqualified. In addition, it is necessary to rationally regulate the combustion condition of the boiler, improve the combustion technology, make the coal fully contact with the air, improve the combustion efficiency of coal combustion, and reduce the oxygen content.

Again, use additives properly. Acidic substances are important conditions for low-temperature corrosion, so the rational use of additives can neutralize acidic substances, thereby reducing the incidence of low-temperature corrosion. Oxygen is also one of the prerequisites for the formation of sulfuric acid, so it is possible to reduce the corrosion by using additives for substances that react easily with oxygen at high temperatures. Common additives include solids, liquids, gases, etc. The fixed types include oxides such as magnesite, dolomite, silicon, zinc powder, and boron. The liquids are mainly aqueous magnesium chloride, and the gases mainly refer to nitrogen. Although the use of additives has a good effect on the prevention of low temperature corrosion, the additives should be reasonably selected according to different environmental conditions in the specific application process, otherwise the effect of the additives will be directly affected.

Finally, the boiler tail is heated by a corrosion-resistant material. The use of corrosion-resistant materials in parts of the boiler that are susceptible to low-temperature corrosion can increase the smoke temperature of the equipment and greatly reduce the incidence of low-temperature corrosion. Although the cost of corrosion-resistant materials is higher than that of ordinary steel pipes, such as glass tube type, heat pipe type, etc., low-temperature corrosion of the heating surface of the boiler tail will significantly reduce the operating efficiency of the boiler, and will reduce the service life of the equipment, and the equipment will be improved invisibly. The use cost; and the anti-corrosion material has the advantages of small resistance, small volume, strong corrosion resistance and long service life, thus virtually reducing the input cost of the equipment.

3. Analysis of Other Problems in the Heating Surface of the Tail of Thermal Power Plant Boiler

In addition to wear and low temperature corrosion, there are some other problems in the heating surface of the tail of the thermal power plant boiler. The maintenance of these problems cannot be ignored in daily work, including the following:

If the tail heating plate tube fixing card assembly is deformed or loosened, the components such as the low temperature superheater, the economizer tube row and the low temperature reheater will be delineated to different extents, especially the low temperature reheater tube row and low temperature. The probability of desuperheating of the superheater tube row is greater, and this problem becomes more and more serious as the unit running time increases. The tail-heated surface tube discharge column will affect the circulation of the flue gas, aggravate the wear, the pipe will become thinner and thinner, and eventually the over-explosion will occur. For this question, next week, two sets of tube row fixing clips can be installed at the front of the low temperature superheater fixed card position 50cm and the rear side 150cm, and then a set of tube row fixing clips are arranged in the middle of the low temperature reheater tube row. By adding a tube row fixing clip, the overall clamping force of the tube row can be increased.

During the normal operation of the boiler, the air pressure in the furnace is lower than the air pressure outside the boiler. Otherwise, smoke, fire, ash, etc. may occur. If the boiler leaks, it will directly affect the overall operation quality of the boiler. Boiler leakage includes air leakage from the air preheater, air leakage from the furnace, and air leakage from the flue. The air leakage from the flue will not only increase the power consumption of the fan, but also consume a large amount of heat, which will have a more serious impact on the operating efficiency of the boiler. For the problem of air leakage on the heating surface of the boiler, the following measures can be taken:

First of all, because many thermal power plant boilers use light pipe materials, although the light pipe material improves the operating efficiency of the boiler under normal operating conditions, the probability of air leakage is also high, so the fin material can be used instead of the light pipe material. To reduce the problem of air leakage. Secondly, strengthen routine maintenance and repair work such as air leakage inspection, air leakage maintenance, material improvement, etc., and perform maintenance in strict accordance with equipment maintenance and operation standards. Finally, if the insulation material needs to be used after the maintenance, the maintenance work of the insulation material should be done. In addition, the sealing box and the refractory brick can be added at the entrance door of the high temperature section.

The leeward side of the heated pipe tends to accumulate a large amount of loose ash. Although the cross section of the ash and the pipe is streamlined, it will not affect the ventilation resistance of the flue, but the excessive ash of the heated area will increase the heat transfer resistance of the pipe wall. Affects its normal heat transfer, so take the following measures to reduce the accumulation of ash:

First of all, in the design and manufacture stage of the boiler, the smoke velocity of the tail heating surface should be fully considered. Under the rated load, the smoke velocity is at least 6m per second, and the general requirement is 8-10m per second. If the fuel with sublimation alkali metal salt is used. The speed of smoke is even higher. Moreover, due to the severe deflection of the flue gas, the local smoke velocity is too low, and the scouring effect is reduced, which causes the ash to slowly develop into ash blocking, which causes partial heating surface failure. Therefore, it is necessary to prevent the flue gas in the flue from being deflected and avoid heat. Deviation and localized ash. Secondly, for the heating surface area where the bonding stone may appear, since this part is prone to ash accumulation, it is reasonable to use small diameter tubes, staggered arrangement, vertical preheater, proper use of dense rows, fin tubes, etc. Structural measures to reduce the accumulation of ash. Again, select the appropriate soot blowing device, reasonably determine the soot blowing position, the soot blowing interval and the duration of soot blowing, and remove the ash in time; select the applicable soot blowing medium according to the actual situation. The commonly used soot blowing medium includes superheated steam and compression. Air, pressure water, ultrasonic soot blowing, etc. can also be used. Finally, reasonable control of the fineness of the pulverized coal furnace, to minimize the fineness of the pulverized coal, to reduce the fine ash deposition; in addition, it is also possible to set the regulating baffle in the flue, the regulating baffle will exit when the load is lower than the set value Part of the flue operation, to avoid the problem of dust accumulation and ash blocking due to too low smoke speed.

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